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ABSTRACT

This paper focuses on the authors' experiences with interactive, synchronous Internet video conferencing using Microsoft's NetMeeting software with deaf and hard-of-hearing students in two different settings. One setting involved teaching and tutoring computer programming to remote deaf and hard-of-hearing students in a remote situation using synchronous Desktop Video Conferencing (DVC) using Logitech cameras mounted on the computer of each participant. A second setting involved the use of NetMeeting by deaf and hard-of-hearing students enrolled in an Internet Communication course. Students in this course were introduced to the various communication tools contained within NetMeeting and provided with experiential lab activities designed to simulate the work environment and facilitate communication with hearing colleagues. In addition, online office hours were offered to provide additional experience with NetMeeting and promote access from remote locations. (Author)

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Abstract: This paper focuses on the authors' experiences with interactive, synchronous internet video conferencing using Microsoft's NetMeeting software with deaf and hard-of-hearing students in two different settings. One setting involved teaching and tutoring computer programming to remote deaf and hard-of-hearing students in a remote situation using synchronous Desktop Video Conferencing (DVC) using Logitech cameras mounted on the computer of each participant. A second setting involved the use of NetMeeting by deaf and hard-of-hearing students enrolled in an Internet Communication course. Students in this course were introduced to the various communication tools contained within NetMeeting and provided with experiential lab activities designed to simulate the work environment and facilitate communication with hearing colleagues. In addition, online office hours were offered to provide additional experience with NetMeeting and promote access from remote locations.

Introduction

In the past, distance learning with two-way video was out of reach for many remote students and institutions. Recent innovations in telecommunications have lowered equipment and transmission cost, making two-way desktop video feasible for businesses, classrooms, libraries, and even homes. In the education of deaf students, video conferencing is also becoming more prevalent due to the inexpensive pricing of desktop cameras and hand-held camcorders as well as the increased access speed at which the deaf and hard-of-hearing audience is accessing the Web. The terrible events of September 11th have also discouraged travel and encouraged the use of remote interactions.

In this paper, the authors share their experience in two different arenas. One area is teaching computer programming courses to deaf and hard of hearing students in remote locations. In these courses Desktop Video Conferencing (DVC) was used in remote, synchronous tutoring sessions. A second area where DVC technology is being used extensively is in instructional efforts designed to facilitate communication between deaf, hard-of-hearing and hearing colleagues in the workplace. Through the use of DVC technology, communication barriers imposed by traditional telephone technology can be overcome to facilitate communication and collaboration. Knowledge and experience gained by deaf and hard-of-hearing students enrolled in the NTID Internet Communication course can be directly applied to the workplace to enhance communication.

Affordable broadband connections and technologies at home, work and school are rapidly growing. These high-speed connections are changing the capability of carrying large amounts of text, voice and video data over existing telephone and cable lines. Microsoft summarized the technology in a very

concise manner: "For years now, computer networks such as the Internet have been carrying text-based messages around the world. Most often, these messages take the form of electronic mail, though real-time chat programs are also used. As the quality and speed of computer networks increase, so do demands for higher levels of interaction that include voice, graphics, and video exchange in real-time. This growing trend toward richer communications via computer is known as Internet Conferencing." (Microsoft, 2001, USA-L_News@yahoo.com)

Various researchers have investigated the transmission of sign language, which features significant motion of the arms and hands, and requires a frame rate high enough for smooth motion perception (Schumeyer, Heredia, & Barner, 1997). Science teachers such as Mary Ellsworth at the Model Secondary School for the Deaf in Washington, DC (<http://csc.gallaudet.edu/soarhigh/SHMAHOM.HTM>), have also previously experimented with computer-based videoconferencing over ISDN lines. Such research and instructional efforts are pioneering. Educators of deaf students eagerly await progress with the new technologies.

The Study

The experiments reported in this paper were action research projects conducted in search of ways to enhance distance learning. The "findings" are thus tentative and provide suggestions for more formal research.

Synchronous Tutoring in Distance Learning Computer Programming Courses

Most of the Distance Learning (DL) courses at Rochester Institute of Technology (RIT) and the National Technical Institute for the Deaf (NTID), one of RIT's colleges, have focused on asynchronous (any time, any place) delivery of instruction. After teaching multiple remote, DL computer programming courses to a deaf and hard-of-hearing audience, however, it was found that both synchronous and asynchronous types of online instruction are necessary for some students to have a successful distance learning experience.

One author tutored remote deaf and hard-of-hearing students via a QuickCam Desktop Camera in conjunction with Microsoft's NetMeeting as an asynchronous tool for clarifying concepts with one deaf student and one teacher. This is often referred to as point-to-point video conferencing, where only two people can talk and see each other at a time. Although this hardware and software can easily incorporate group conferencing of remote students by the instructor, the project reported on in this paper involved only point-to-point video conferencing. The students selected were tutored on an individual basis in a credit-bearing DL course in Visual Basic Programming.

Desktop Video Conferencing (DVC) is one of many different types of conferencing tools. The DVC components include a video conferencing camera, such as the QuickCam camera used for this project, an Internet telephony application, a microphone, and speakers mounted to the local computer (the microphone and speaker built into a laptop computer were found to be adequate). DVC links two or more participants at different sites by using computer network(s) to transmit data. DVC is based on Codec (compressor-decompressor) technology. A Codec works via a mathematic computer algorithm to compress and decompress digital data. The data can be video, audio, or text based. A Codec is an important part of any Internet telephony application such as Microsoft's Netmeeting.

To use Desktop video conferencing, the student and instructor both need to have a computer, a camera, and an Internet connection to send and receive the video. From the authors' experience, the computer should be a Pentium-based PC running on Windows 95, 98, NT or Windows 2000. The authors have no experience with the new XP, Linux or other operating systems yet. The faster the processor speed the better the video will run. All the Pentium based processors are more than adequate to handle DVC. The user should have at least 32 MB RAM, although more memory will be better, especially if the user plans to

have other applications open when using DVC. The PC should have enough hard disk space for file swapping; at least 20 MB would be a minimal requirement. A video capture card is also necessary.

The Internet connection for conferencing should be as fast as possible. It is recommended that both users be connected at speeds much faster than the Plain Old Telephone System's (POTS) 28.8 kb per second. A Local Area Network (LAN) with Roadrunner™, Integrated Services Digital Network (ISDN™), the Digital Subscriber Line (DSL™), or T1 connection would be optimal. Temasek Polytechnic does an excellent job of laying out system requirement and step-by-step instructions on how to set up DVC on their website. (Temasek Polytechnic, 2001, <http://eicu.tp.edu.sg/DVC/index.htm>)

The camera chosen should be a desktop type of camera that easily interfaces with the computer. Although the QuickCam had many features for storing photographs, it was the video feature of the DVC and the low price that was the most appealing for the project discussed in this paper. The QuickCam camera is capable of recording video at up to 30 frames a second.

NTID Telecommunications Curriculum

NTID has a long history of providing technical and communication training to deaf and hard-of-hearing students. Initially, curriculum designed to provide communication training in the area of telecommunications focused exclusively on the use of traditional telephone/TTY technology to facilitate remote communication in the workplace. In more recent times, with the advent of DVC and text-based communication technologies utilizing the Internet, curricular offerings have expanded to reflect the vast array of technologies that are now available to facilitate communication between deaf, hard-of-hearing, and hearing employees in the workplace.

DVC technology has been a major component of the NTID telecommunications curriculum since the early to mid 90's. At that time, instructors began experimenting with a beta version of Cornell University's CU-SeeMe videoconferencing software. When used in conjunction with a grayscale Connectix QuickCam and Ethernet connection, students were able to place point-to-point videoconference calls throughout the world via the Internet. As an example, calls were regularly placed between deaf students at NTID and those attending the Tsukuba College of Technology in Japan. Although quite unsophisticated by today's standards, this technology opened door for deaf and hard-of-hearing students seeking employment by providing an inexpensive means of facilitating communication through the use of real-time video and text-based chat.

A survey of students conducted at NTID revealed many positive attributes regarding this technology (MacKenzie & Clymer, 1999). In particular, students commented on how DVC allowed them to visually identify a caller and gain information on their mood and emotions by analyzing facial expressions and body movement. In addition, they found it extremely beneficial having both video and text-based chat available for real-time remote communication.

Since then, several newer DVC systems have been incorporated into the NTID telecommunications curriculum for students to evaluate. Of these, NetMeeting has quickly become popular among students since it offers an inexpensive means of establishing point-to-point videoconference calls. As part of NTID's Internet Communication course, students are introduced to NetMeeting and its wide array of communication/collaboration tools including video, text-based chat, file transfer, whiteboard, and application sharing capabilities. Through the use of structured lab assignments designed to simulate situations common to the workplace, students gain first hand experience with NetMeeting with the ultimate goal of enhancing communication and collaboration with their hearing colleagues. Instructors have also begun offering online office hours using NetMeeting, provide students with additional opportunities to evaluate the software and promoting greater access for those who desire to discuss course information or review class assignments outside the traditional class schedule.

Conclusions

DVC is both inexpensive and easy for instructors and students to implement. The technology significantly enhanced remote tutoring sessions by making remote interactions more personal. Communication with the deaf and hard-of-hearing relies heavily on facial expressions, body language and gestures. DVC, when combined with the other tools mentioned in this paper, provided an adequate environment for successful remote tutoring sessions.

In distance learning tutoring for the deaf and hard-of-hearing, DVC is often too slow and choppy for fluid, extended sign language conversations, but it does allow the sharing of some limited sign language, gestures, facial expressions and body language. This real-time interaction significantly enhances chat sessions and white board viewing of instructional material such as text explanations or computer program source code. Netmeeting also allows the use of highlighting and drawing on top of instructional materials, which can easily be posted on the online white board or even saved later in an electronic conference.

Video conferencing is becoming more affordable as use of broadband connections and technologies such as ISDN, DSL and Road Runner at home, work and school increase. These high-speed connections will change the capability of carrying large amounts of text, voice and video data over existing telephone and cable lines. Videoconferencing systems also incorporate compressed digital video. This compression technology makes the transmission of video less costly by reducing the size of the video needed to be transmitted.

Broadband access has also impacted DVC and other types of video conferencing. A survey taken last year of 2000 online RIT students, of which 50 were deaf, gathered a 10% response rate and found that 70% of these students had access to broadband Internet access at home, work or school. (Fasse, 2000) Of the 20 respondents to a fall, 2001 academic quarter survey of exclusively 33 RIT deaf and hard-of-hearing online students, 85% of these learners had access to high-speed internet access while 100% of all on-campus students have capability to this access. (Mallory, Long, 2001) According to AOL, Americans with online access has increased from 45 million users in 1998 to 105 million users in 2001. Of these online users, those with home broadband access has grown from 6% in December, 1999 to 19% as of September, 2001. (Mount, 2001, pp. 44-45) This shift in the access speed of the student population makes video streaming an increasingly viable option for delivering synchronous communication and instruction.

Desktop Video Conferencing (DVC) is a widely available, low cost, practical technology that can be used in synchronous, online tutoring/teaching sessions. Although the limited throughput on the Web makes it challenging to observe sign language in a fluid and practical manner as a primary instructional or conversational tool in online courses, it has been useful as one means of tutoring remote deaf students when used in conjunction with a complete DVC package. A DVC package with a desktop camera allows the sharing of some sign language, gestures, facial expressions and body language. This real-time interaction significantly enhances chat sessions and white board viewing of instructional material such as programming code. Netmeeting also allows the use of highlighting and drawing on top of instructional materials, which can easily be posted on the online white board along with a chat session interaction. When the DVC video was combined with Microsoft NetMeeting's other features, the total package was found to be an excellent communication and instructional tool.

The hardware, software, and Internet connections are now available to provide a complete Internet conferencing solution such as DVC at a very reasonable price. DVC incorporates the use of desktop cameras and software that can provide an adequate environment to perform remote, synchronous tutoring for deaf and hard-of-hearing students. With the increase in digital compression technology and students increased connectivity at high-speed, broadband access speeds, use of digital video conferencing will continue to grow.

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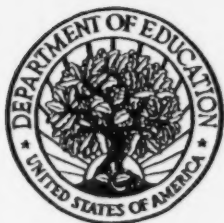
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